

Nutrition

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"Nutrition is the process of procuring and utilization of food."

1.1 Introduction

All living organisms require energy and other raw materials for performing all the vital activities and for body building, repair, growth, development and regulation.

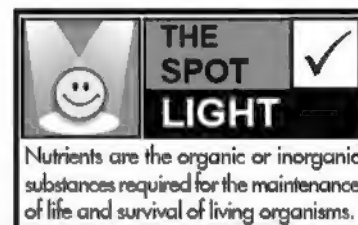
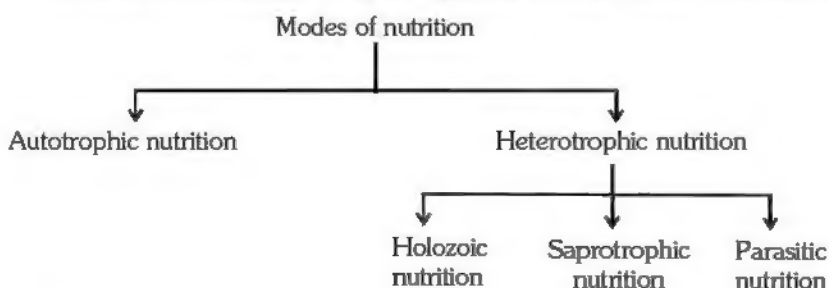
Both energy and raw materials are obtained from the food. The food taken in by an organism contains a large number of nutrients like carbohydrates, fats, proteins, minerals, vitamins and water. Carbohydrates and fats provide energy. Proteins are required for body building, growth and healing. Vitamins and minerals are the regulating nutrients.

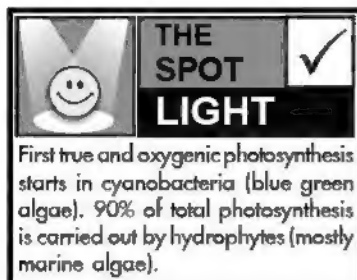
1.2 Nutrition

Nutrition is the process of intake of nutrients (like carbohydrates, fats, proteins, minerals, vitamins and water) by an organism as well as the utilisation of these nutrients by the organism.

Modes of nutrition

Methods of obtaining food by the organisms are called modes of nutrition.





1.3 Autotrophic nutrition

It is the process by which organism take in simple inorganic substances from outside and use them to synthesize organic molecules and then convert into stored forms of energy. For example green plants prepare their food by using carbon dioxide and water in the presence of chlorophyll and sunlight. The organisms having autotrophic mode of nutrition or can make their own food are called autotrophs or autotrophic organisms.

Examples : Green plants and some bacteria.

BUILDING CONCEPTS 1.1

What would happen if green plants disappear from earth?

Explanation

Green plants are the source of energy for all organisms. They trap the solar energy and convert it into chemical energy in the form of food (starch) and they give off oxygen. If all green plants disappear from the earth then all the herbivores will die due to starvation and so will the carnivores. Also without plants animals would have no oxygen to breathe and would die.

Photosynthesis

Photosynthesis is the process of preparing organic food (carbohydrate) by combining carbon dioxide and water, using solar energy by chlorophyll pigments.

The sugar produced in photosynthesis is stored in the form of starch in plants and it is the source of reserved internal energy.

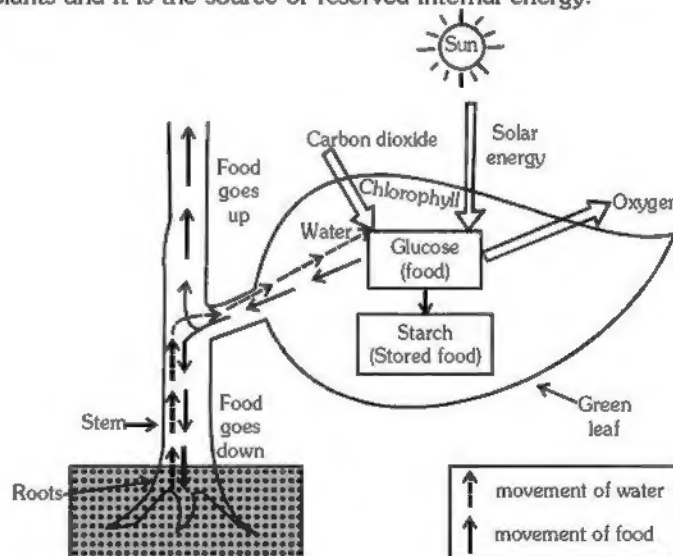
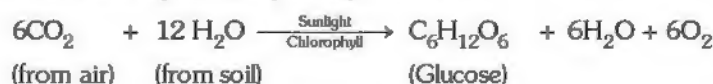


Fig.1 Green plants make their own food by photosynthesis

The overall equation of photosynthesis is

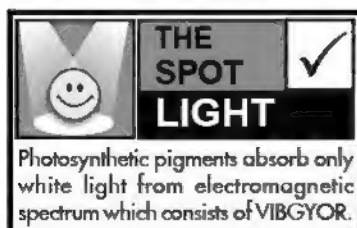


Requirements for photosynthesis

- | | |
|--------------------|----------------------------|
| (1) Sunlight | (2) Photosynthetic pigment |
| (3) Carbon dioxide | (4) Water |

1. Sunlight

Sun is a natural source of light for photosynthesis.



ACTIVE BIOLOGY 1.1

Aim

To demonstrate that sunlight is essential for photosynthesis.

Method

Take a potted plant and keep it in a dark place for 2-3 days so that leaves get destarched. Fold a circular black paper and cut a design in its centre. Fix black paper or tin foil, with the cut design in its centre on the surface of a leaf of destarched potted plant by means of cellotape strips or clips. Alternately attach a Ganong's light screen over it. Ganong's light screen is a small metallic box with a spring handle, ventilating holes and a lid having a design cut in the centre.

Expose the plant to sunlight for 2-3 hours. Remove the black paper or Ganong's light screen. Pluck the leaf. Test it for starch by first boiling in water for 5-10 minutes, to kill the cells drying in folds of blotting paper, dipping in warm denatured spirit for 30-45 minutes, to remove chlorophyll from leaf washing with water and pouring iodine over it.

Observation

Covered part of leaf remains yellow while parts of leaf which received light turn bluish black. Bluish black colour indicates the presence of starch or photosynthesis.

Conclusion

Only that leaf part shows photosynthesis or positive starch test which is exposed to light. The covered part which does not receive sunlight does not perform photosynthesis as is evident from the absence of starch. Therefore light is necessary for photosynthesis.

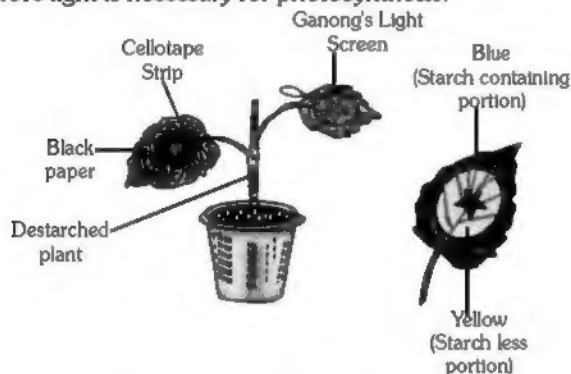


Fig.2 Light is necessary for photosynthesis

2. Photosynthetic pigments

These are chlorophylls which are responsible for absorbing light energy. Photosynthetic pigments are present in all the green parts of the plant.

ACTIVE BIOLOGY 1.2

Aim

To demonstrate that chlorophyll is necessary for photosynthesis.

Method

Destarch a potted plant of Croton or Pothos (Money Plant) having variegated leaves (contains both green and non green parts) by keeping it in complete darkness for two days. Expose the destarched potted plant to sunlight for two hours. Pluck a variegated leaf. Place a rice paper over it. Draw the outline of green and non-green areas. The green areas contain chlorophyll. The non-green areas are pale in colour and devoid of chlorophyll. Place the leaf in boiling water for 5-10 minutes. Boiling kills the leaf. Dip the leaf in spirit or alcohol kept at 50°-60° C with the help of a water bath. After 30-45 minutes, the leaf will be decolourised completely. Take out the decolourised leaf, dip in hot water for softening the same. Spread the leaf in a petri dish. Pour dilute iodine solution over the leaf. After 4-5 minutes, rinse off excess iodine and observe.

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Destarching means to remove starch content from a plant or leaf by keeping the plant in dark room for 2-3 days because of which plant cannot photosynthesize and uses up stored starch and is destarched.

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LIGHT

Test for starch : When iodine reacts with starch, it produces blue-black colour, indicating the presence of starch.

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The plants reflect mainly the green colour of the white light falling on them due to the presence of chlorophyll, so plants look green to us.

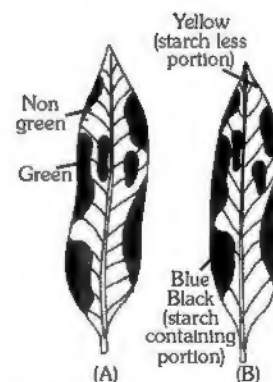


Fig.3 Variegated leaf (A) before and (B) after starch test

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Desert plants take up CO_2 at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day and form glucose.

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In aquatic plants, CO_2 is obtained from the water where it remains present in dissolved form. Such plants absorb carbon dioxide in dissolved form through diffusion, all over their surface from the surrounding water.

Observation

Leaf (B) has two types of patches, bluish black and yellowish. The bluish black areas are the ones which have starch. The bluish black colour is due to reaction of iodine with starch. The yellow areas are without starch. Compare leaf (B) bluish black and pale areas with leaf (A) green and non-green areas sketched on rice paper. Leaf (B) bluish-black areas are the ones which were green previously of leaf (A) while non-green of leaf (A) areas remain pale coloured.

Conclusion

Only chlorophyll containing areas produce starch which is product of photosynthesis. Therefore, chlorophyll is necessary for photosynthesis.

3. Carbon dioxide

All the plants need carbon dioxide to form carbohydrates. The carbon dioxide is obtained by the plants from the atmospheric air. In the terrestrial plants, the CO_2 enters into the cells of leaves through tiny pores called stomata which always remain present on the surface of leaves.

ACTIVE BIOLOGY 1.3**Aim**

To demonstrate that carbon dioxide is necessary for photosynthesis.

Method

Take two potted plants which have been destarched by keeping them in dark for three days. Place them on glass slabs. Keep a watch glass having (KOH) potassium hydroxide solution on one slab. Invert bell jar over each potted plant. Seal the edges of bell jars by vaseline. Place the two sets in the sunlight. After two hours pluck one leaf from each pot and test the same for starch.

Observation

The leaf of the set (B) which was without potassium hydroxide solution turns blue-black while the leaf of the other set (A) with potassium hydroxide solution remains pale coloured.

Conclusion

Leaf of set (B) which turns blue-black has synthesized starch by the process of photosynthesis. Its bell jar contains carbon dioxide as there is no potassium hydroxide. Leaf of set (A) has not synthesized starch. Photosynthesis did not occur. The bell jar of set (A) does not contain carbon dioxide as the same is absorbed by potassium hydroxide solution. Therefore, carbon dioxide is necessary for photosynthesis.

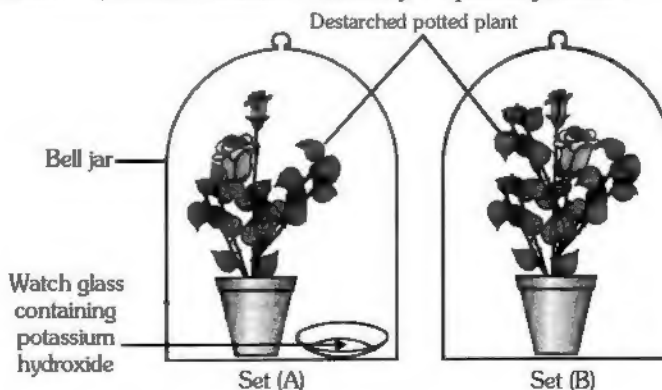


Fig.4 Carbon dioxide is necessary for photosynthesis

Stomata

These are tiny pores or microscopic aperture guarded by two kidney shaped or bean shaped guard cells.

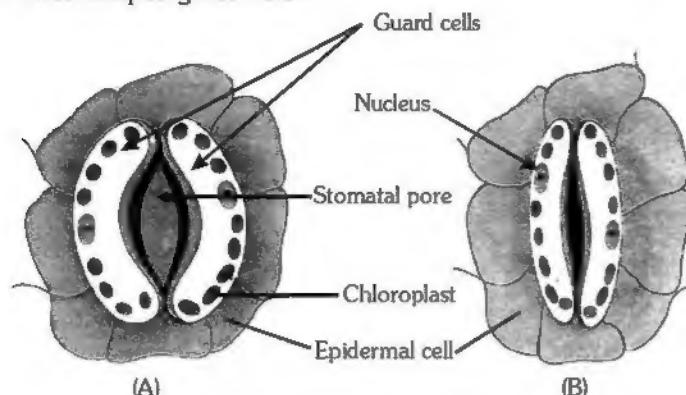


Fig.5 (A) Open Stomata (B) Closed Stomata

Functions of stomata

- (i) Massive amount of gaseous exchange takes place in the leaves through stomata. Exchange of gases also occurs across the surface of stem, root and leaves.
- (ii) Transpiration takes place through the stomata. Large amount of water is lost in the form of water vapour through stomata is known as transpiration.

Guard cells

These are kidney shaped cells which cover single stoma. They contain chloroplast also.

Function of guard cells

They regulate the opening and closing of the stoma and also perform photosynthesis.

Opening and closing of stomata

When the guard cells swell (turgid) due to the entry of water, the stomata open. But when the guard cells shrink (flaccid) due to the loss of water, the stomata gets closed.

4. Water

Water is always needed by the plants for its use during photosynthesis. It is absorbed by the roots of the plant from the soil through the process of osmosis.

Inside the chloroplasts of the leaves, the water molecules split into hydrogen and oxygen with the help of light energy of sun.

Some mineral salts like Nitrogen, Phosphorus, Iron, Magnesium required by the plants are also transported to different parts of the plant along with the water.

CHECK YOUR CONCEPTS 1.1

1. The leaves of a plant prepare food A by photosynthesis. Food A then gets converted into food B which is stored in the leaves. What are A and B?
2. Why do we boil the leaf in alcohol when we are testing it for starch?
3. What element does a plant need to be able to convert glucose into proteins?
4. What type of the plants do we use in the experiment to prove that chlorophyll is necessary for photosynthesis?

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Generally stomata are opened during day time and closed during night time but in desert plants stomata are opened in the night time to check excessive loss of water.

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Nitrogen is an essential element used in the synthesis of proteins and other compounds (chlorophyll, DNA and RNA). Nitrogen is taken up in the form of inorganic nitrates or nitrites which have been prepared by nitrogen fixing (symbiotic and non-symbiotic) bacteria from atmospheric Nitrogen.

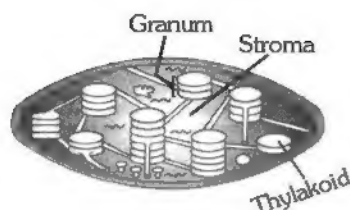


Fig.6 Chloroplast

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Thylakoid membrane have chlorophyll pigment (which is a magnesium containing pigment) to capture sunlight, maximum in the violet, blue and red colour spectrum of VIBGYOR.

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Photophosphorylation : Production of ATP from ADP and inorganic phosphate in the presence of light.

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Photolysis is the splitting of water molecule in the presence of light.

BUILDING CONCEPTS 1.2

Why does less availability of water reduces the rate of photosynthesis?

Explanation

Under water deficient conditions the stomatal aperture remains closed to reduce the loss of water by transpiration. As a consequence the entry of CO_2 is also stopped into the leaves. That's why rate of photosynthesis will be reduced.

Site of photosynthesis

Photosynthesis takes place in the green plastid (Chloroplast or Kitchen of the cell) in green tissues inside leaves and young stem.

When we observe the cross section of a leaf under microscope, we can see the mesophyll cells full of green dots. These green dots are chloroplasts containing chlorophyll pigments.

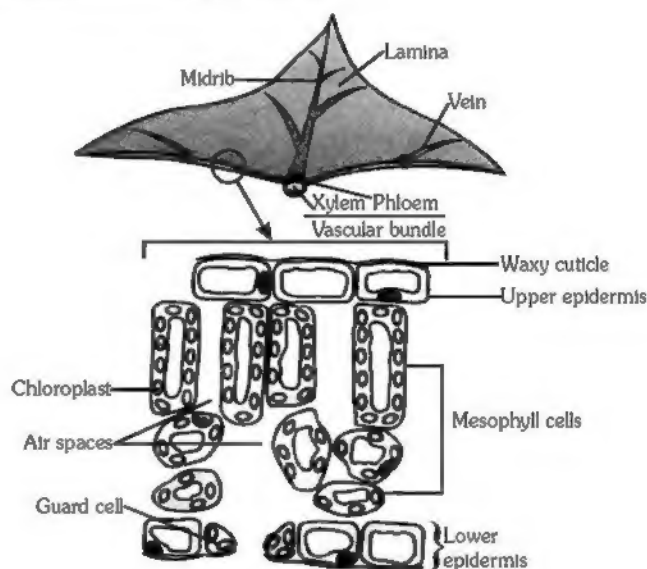


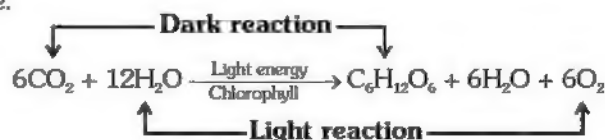
Fig.7 Cross section of leaf

Mechanism of photosynthesis

During photosynthesis following events occur

- (i) Absorption of light energy by chlorophylls.
- (ii) Conversion of light energy into chemical energy and splitting of water molecule into hydrogen and O_2 .
- (iii) Hydrogen reduces CO_2 and synthesizes glucose (reduction of CO_2 in to carbohydrates).

All these events can be categorised into two main phases, light phase and dark phase.



Difference between Light and Dark reactions

Features	Light reaction	Dark reaction
Requirement of light	Required	Not required
Takes place inside	Grana part of the chloroplast.	Stroma region of chloroplast.
ATP and NADPH ₂	ATP and NADPH ₂ are produced by the conversion of light energy into chemical energy	ATP and NADPH ₂ formed during light reaction are used for the fixation of CO ₂ into carbohydrate
Sugar formation	No sugar formation takes place	Sugar formation takes place
Release of oxygen	Oxygen is released	No oxygen is released

Factors affecting photosynthesis

(a) Light (b) Water (c) Temperature (d) CO₂ (e) Oxygen

Importance of photosynthesis

- Photosynthesis is an anabolic process in nature for providing food supply to the living organisms.
- It purifies the atmospheric air, by consuming CO₂ and evolving oxygen.
- It converts light energy into chemical energy.

CHECK YOUR ANSWERS 1.1

- (A) Glucose (B) Starch
- To remove the chlorophyll pigments from the leaves.
- Nitrogen.
- Destarched potted plants with variegated leaves (leaves which have both green and non green parts) eg. Croton and Pothos.

1.4 Heterotrophic nutrition

Mode of nutrition in which the organisms derive their nutrition by taking readymade food, from other dead or living plants and animals. The survival of heterotrophs depends directly or indirectly on autotrophs e.g., Animals, fungi and most of bacteria.

Heterotrophic mode of nutrition is classified into three types on the basis of methods of obtaining food.

(i) Holozoic nutrition - Ingestive nutrition

Mode of nutrition in which, the animals take complex solid food or whole material and break down (digest) it inside the body. They may be herbivores (Cow), carnivores (Lion) and omnivores (Rat).

(ii) Saprotrophic nutrition

In this type of nutrition the organisms obtain their food from decaying organic substances. They are also called saprotrophs. They breakdown the food material outside the body and then absorb it. e.g., Bacteria, Fungi (bread moulds, yeasts and mushrooms).

(iii) Parasitic nutrition

Mode of nutrition in which organisms (parasite) derive nutrition from other plants and animals (host) without killing them. e.g., *Cuscuta* (Amarbel), ticks, lice, leeches and tapeworms.

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Organism which lives in/on the body of host and derive their nutrition from them is called parasite and organisms which provide food and shelter to the parasite are called host.

THE SPOT LIGHT

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In *Paramecium*, the cell has a definite shape and a specific spot for ingestion of food. The food is moved to this spot by the movement of cilia, which cover the entire surface of cell.

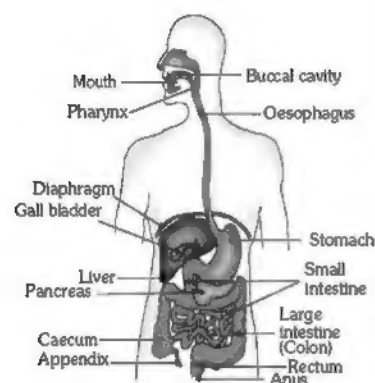
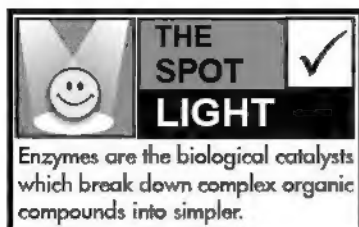


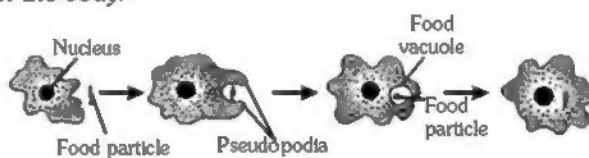
Fig.9 Human alimentary canal



1.5 Nutrition in animals

The digestive system is different in various organisms since the food and the way it is obtained differs in these organisms. The mode of nutrition in *Amoeba* is holozoic and it is omnivorous.

- When *Amoeba* comes in contact with food particles, it forms pseudopodia which engulf the prey by forming a food cup. This process is ingestion or phagocytosis.
- When the tips of encircling pseudopodia touch each other, the food is captured into a bag called food vacuole. The food vacuole serves as a temporary stomach secreting digestive juices.
- The digested food gets absorbed and diffuses into the cytoplasm and then assimilated.
- Assimilation is the utilization of digested food in various anabolic and catabolic reaction conversion (resynthesis) of absorbed food into complex molecules for various purpose such as production of energy growth, repair and storage.
- The egestion of undigested food takes place at any point on the surface of the body.

Fig.8 Nutrition in *Amoeba*

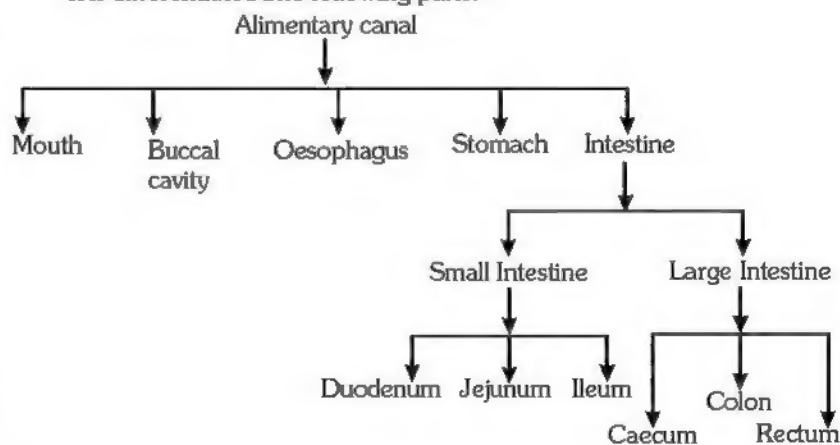
1.6 Digestive system of human

Human digestive system consists of the alimentary canal and digestive glands and it involves mastication, swallowing, digestion of food and elimination of undigested matter.

Alimentary canal

The alimentary canal is basically a long tube extending from the mouth to the anus.

It is differentiated into following parts.



1. Mouth

It is a transverse slit bounded by two soft movable lips. The lips serve to close and open mouth, holding the food in between and also help in speaking.

2. Buccal cavity / mouth cavity / oral cavity

Mouth leads into a large space known as mouth cavity or oral or buccal cavity. It accomodate muscular tongue, teeth and salivary glands.

(i) Tongue

The floor of the mouth cavity is occupied by large, muscular, mobile tongue. It is the organ of taste with taste buds on its upper surface.

Functions of tongue

- (i) It moves food in buccal cavity for mixing of saliva.
- (ii) It helps in swallowing food.
- (iii) It plays a role in speech.
- (iv) It helps to clean the teeth.

(ii) Teeth

Four different types of teeth are present in our buccal cavity which help in crushing of food.

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Four types of teeth found in humans are Incisors (biting the food), Canines (wearing and tearing of food), Premolars and molars (crushing and grinding of food).

BUILDING CONCEPTS 1.3

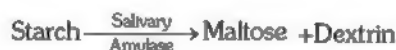
What are dental caries and how are they caused?

Explanation

It is the tooth decay which involves destruction of the enamel layer of the tooth. It begins when bacteria acting on sugars produce acids that softens or demineralises the enamel, masses of bacterial cells together with food particles stick to the teeth to form dental plaque. If the dental caries are not treated, it can spread to the dentine and pulp of the tooth, causing infection and inflammation of the tooth.

(iii) Salivary glands

These secrete saliva which contains a digestive enzyme called ptyalin or salivary amylase that breaks down starch.



ACTIVE BIOLOGY 1.4

Aim

Study of action of saliva on starch.

Method

Pour 1 ml of 1% starch solution in each of two test tubes, (A) and (B). Pour 1 ml of saliva over the starch solution of test tube (B) and shake well. After 15 minutes add 1–2 drops of iodine solution in both the test tubes, (A) and (B).

Observation

Starch solution of test tube (A) turns blue. There is no change in colour of solution in test tube (B). Only pale yellow colour of iodine is observed.

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Saliva is an antiseptic as it kills germs and bacteria due to presence of an enzyme called lysozyme. Saliva makes the food soft and slippery and helps in digestion of starch.

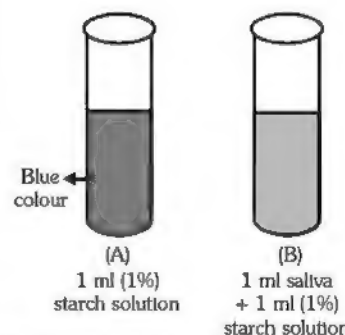




Fig.10 Study of action of saliva on starch




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Digestion of proteins in man starts from stomach. In buccal cavity there is no digestion of proteins because saliva does not contain proteolytic (protein digesting) enzyme.



THE SPOT LIGHT

An ulcer on the inner lining of the stomach is called peptic ulcer which is caused by the higher acidity of gastric juice secretions.



THE SPOT LIGHT

Emulsification is the phenomenon of physically breaking of large sized fat globules into large number of fat droplets by the bile-salts of the bile juice. This increases the surface area for digestion of fats by the lipase enzyme.

Conclusion

Iodine solution reacts with starch to form blue-coloured product. The reaction is almost immediate. This happens in test tube (A). In test tube (B) no such change occurs, indicating that its starch has been broken down into simpler carbohydrates. This is possible by salivary amylase enzyme present in saliva.

3. Pharynx

The buccal cavity opens into a short narrow chamber called pharynx. It is a common passage for both food and air.

4. Oesophagus (food pipe)

The oesophagus is a collapsible muscular tube leading the food by peristalsis from pharynx to stomach. There are no digestive glands but mucus glands are present.

5. Stomach

It is a thick, muscular and J shaped sac present on the left side of upper part of abdomen just below the diaphragm. Gastric glands are present in the wall of stomach. These release gastric juice which contains mucus, hydrochloric acid and two inactive protein digesting enzymes called pepsinogen and prorennin. The muscular walls of the stomach help in mixing the food thoroughly with digestive juices.

HCl activates pepsinogen to pepsin and prorennin to rennin.



It produces an appropriate acidic medium (pH = 2). It facilitates the action of enzyme pepsin and kills the bacteria present in food.

Pepsin breaks down proteins into peptides.



Rennin is a milk protein digesting enzyme.

Mucus lubricates the food and protects the inner lining of the stomach from the action of HCl.

Sphincter muscles regulate the exit of food from stomach into intestine due to peristaltic waves of stomach.

CHECK YOUR CONCEPTS 1.2

1. When we eat something we like, our mouth 'waters'? What is the actual meaning of this statement?
2. Why food coming from the buccal cavity is to be made acidic?
3. What are peristaltic movements? Why do they occur?

6. Intestine

It is the largest part of alimentary canal which is fitted into a compact space because of extensive coiling. It is distinguished into small intestine and large intestine.

(i) Small intestine

The small intestine is the site of the complete digestion of carbohydrates, proteins and fats. It receives the secretions of the liver and pancreas for digestion.

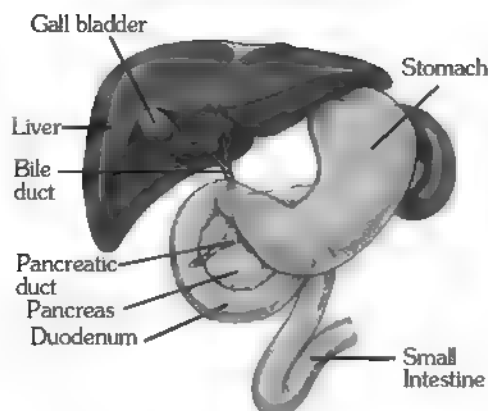
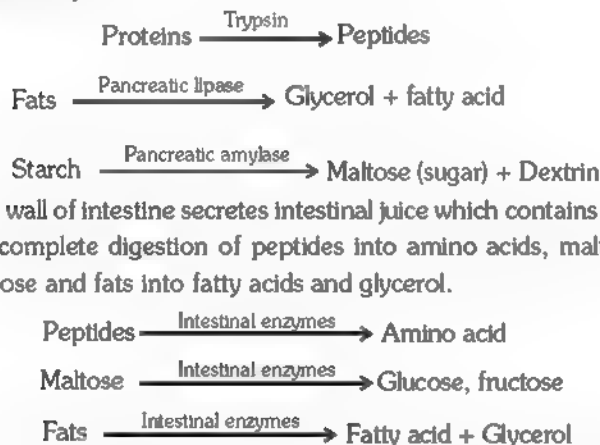


Fig.11 Liver and Pancreas

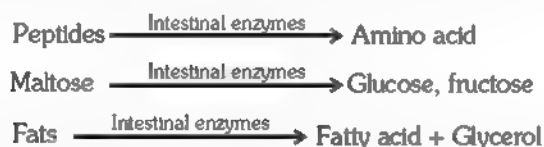
Food is mixed with three digestive juices (bile juice, pancreatic juice and intestinal juice).

Bile juice (from the liver) provide alkaline medium and emulsifies fats (conversion of larger fat globules into smaller fat droplets) but it is a non enzymatic digestive juice so has no chemical action on food.

Pancreatic juice (from the pancreas) contains trypsin, pancreatic amylase and pancreatic lipase enzymes which digest the proteins, starch and emulsified fats into peptides, maltose, fatty acids and glycerol respectively.



The wall of intestine secretes intestinal juice which contains enzymes for complete digestion of peptides into amino acids, maltose into glucose and fats into fatty acids and glycerol.



The inner lining of the small intestine has numerous finger like projections called villi which increases the surface area for absorption of digested food. These are richly supplied with blood vessels which take the absorbed food to each and every cell of the body where it is assimilated for various purposes.

BUILDING CONCEPTS 1.4

It is said that, 'small intestine is the site of the complete digestion'. Why is it so?

Explanation

In the small intestine food is acted upon by the digestive juices of liver, pancreas and small intestine which helps in the complete digestion of carbohydrates, proteins and fats.

THE SPOT LIGHT

Liver is lobed and reddish brown coloured largest gland of body present in the right side of upper part of the abdomen. It synthesise bile juice. Gall bladder is present below the right lobe of liver. It stores and secretes bile

THE SPOT LIGHT

Pancreas is a yellow- coloured gland present just behind the stomach. It secretes pancreatic juice. Pancreatic duct carries pancreatic juice to small intestine.

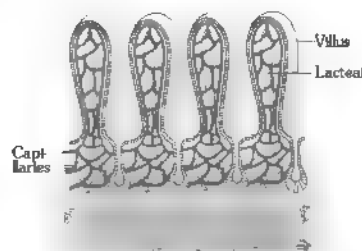


Fig.12 Villi



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The length of small intestine differs in various animals depending on the food they eat. Herbivores eating grass need a longer small intestine to allow the cellulose to be digested. Meat is easier to digest hence carnivore like tiger have a shorter small intestine.

(ii) Large intestine

It is the site of absorption of water from indigestible food. It helps in formation and temporary storage of faeces.

7. Anus

The digestive wastes, solidifies into faeces and is removed/egested (defecation) from the body via anus. The exit of waste material is regulated by anal sphincter.

CHECK YOUR ANSWERS 1.2

1. This is actually not only water, but a fluid called saliva (secreted by salivary glands) which is required for the digestion of starch.
2. The food coming from the buccal cavity is alkaline and has to be made acidic for the proteolytic enzymes to act on proteins.
3. The rhythmic contraction of muscles that takes place all along the alimentary canal is referred to as peristaltic movements. These movements help to push the food forward.

BUILDING CONCEPTS 1.5

Why are villi richly supplied with blood vessels?

Explanation

The blood vessels take the absorbed food to each and every cell of the body, where it is utilised for obtaining energy, building up new tissues and the repair of old tissues.

NCERT QUESTIONS WITH SOLUTIONS

1. What criteria do we use to decide whether something is alive?

Ans. The major criterion which is used to decide whether something is alive is movements. Movements may be that of locomotion (e.g. running of dog), movement of a part (e.g. chewing cud by cow), breathing movements, growth movements (in plants) and movement of molecules in metabolic reactions, maintenance and repair of cellular structures.

Besides movements, other criteria found in living beings that distinguish them from the non-living are presence of protoplasm, self built organisation, self repair, reproduction and various life processes like metabolism, nutrition, respiration, growth, exchange of materials, transportation, excretion and irritability. All living beings have a definite life span and life cycle.

2. What are outside raw materials used for by an organism?

Ans. Outside raw materials provide energy to organisms to maintain their body processes. They are needed to prevent damage and break-down in the body.

3. What processes would you consider essential for maintaining life?

Ans. Life processes like nutrition, respiration, transportation, excretion and awareness are essential for maintaining life.

4. Where does the plants get each of the raw materials for photosynthesis?

Ans. (i) Carbon Dioxide - Air through stomata.
(ii) Water - Soil through roots.
(iii) Minerals - Soil through roots.

5. What is the role of acid in our stomach?

Ans. Hydrochloric acid (HCl) is component of gastric juice. It has five functions, (i) Softening of food, (ii) Conversion of pepsinogen and prorennin into active forms of pepsin and rennin (iii) Acidify the food for

proper action of pepsin. (iv) Killing of microorganisms present in food (v) Stoppage of action of salivary amylase.

6. What is the function of digestive enzymes?

Ans. Digestive enzymes are hydrolytic enzymes which bring about hydrolytic splitting of complex organic substances into simple, soluble and absorbable substances, e.g.,

Protein $\xrightarrow{\text{enzymes}}$ Peptides $\xrightarrow{\text{enzymes}}$ Amino acids.

7. What are the differences between autotrophic nutrition and heterotrophic nutrition?

	Autotrophic Nutrition	Heterotrophic Nutrition
(1)	The process through which organisms are able to build up their own organic food from inorganic substances.	The process in which the organisms derive their nutrition by taking readymade food from other dead or living plants and animals.
(2)	The raw materials are obtained from outside, in the form of carbon dioxide and water.	The survival of heterotrophs depends directly or indirectly on autotrophs.
(3)	Chlorophyll and sunlight are essential for photosynthesis.	Chlorophyll and sunlight are not required.
(4)	E.g., Green plants and some bacteria.	E.g., Animals, fungi and most of bacteria.

8. How is small intestine designed to absorb digested food?

Ans. The inner lining of small intestine has millions of tiny finger like projections called villi. Villi are transverse folds of intestine wall that not only increase surface area but also reach deep into the lumen of intestine for absorption of digested food. Villi possess blood capillaries and lacteals (lymph vessels) for quick transport of absorbed food.

EXERCISE # 1

Multiple choice questions

1. The energy change in photosynthesis is from
 - (1) Light energy to electrical energy
 - (2) Light energy to molecular energy
 - (3) Light energy to chemical energy
 - (4) Light energy to activation energy.
2. Grana are present inside
 - (1) Mitochondria
 - (2) Golgi bodies
 - (3) Chloroplast
 - (4) Ribosome
3. Stomata controls
 - (1) The loss of food material from the plant
 - (2) The loss of water from the plant
 - (3) The loss of air from the plant
 - (4) The loss of energy from the plant
4. Each stoma is guarded by
 - (1) Guard cells
 - (2) Palisade cell
 - (3) Mesophyll cell
 - (4) Parenchyma cell
5. Each guard cell contains
 - (1) Leucoplasts
 - (2) Chloroplasts
 - (3) Starch
 - (4) Oil and protein granules
6. In dark, the guard cells are
 - (1) More turgid
 - (2) Not turgid
 - (3) Less turgid
 - (4) None of these
7. First true and oxygenic photosynthesis starts in
 - (1) Protists
 - (2) Fungi
 - (3) Cyanobacteria
 - (4) None of these
8. Photosynthesis proceeds in sequence of
 - (1) Dark phase and light phase
 - (2) Light phase alone
 - (3) Light phase and dark phase
 - (4) Dark phase alone
9. In light phase of photosynthesis there is formation of
 - (1) ATP
 - (2) NADPH₂
 - (3) Both ATP and NADPH₂
 - (4) Carbohydrates.
10. The oxygen in photosynthesis is released from
 - (1) CO₂
 - (2) H₂O
 - (3) Carbohydrate
 - (4) Chlorophyll
11. The process in which water is split during photosynthesis is
 - (1) Photolysis
 - (2) Hydrolysis
 - (3) Plasmolysis
 - (4) Osmosis
12. Dark reaction of photosynthesis occurs in
 - (1) Grana
 - (2) Stroma
 - (3) Matrix
 - (4) Cytoplasm
13. Which is the first enzyme to mix with food in the digestive tract?
 - (1) Pepsin
 - (2) Cellulase
 - (3) Amylase
 - (4) Trypsin
14. If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected?
 - (1) Proteins breaking down into amino acids
 - (2) Starch breaking down into sugars
 - (3) Fats breaking down into fatty acids and glycerol
 - (4) Absorption
15. Ptyalin is an enzyme present in
 - (1) Gastric juice
 - (2) Pancreatic juice
 - (3) Intestinal juice
 - (4) Saliva
16. Salivary amylase converts
 - (1) Proteins into amino acids
 - (2) Glycogen into glucose
 - (3) Starch into maltose
 - (4) Fats into vitamins
17. The inner lining of stomach is protected by one of the following from hydrochloric acid. Choose the correct one.
 - (1) Pepsin
 - (2) Mucus
 - (3) Salivary amylase
 - (4) Bile
18. Major function of HCl of gastric juice is
 - (1) Providing acidic medium for pepsin
 - (2) Kill virus
 - (3) Dissolve food
 - (4) Facilitate absorption of food
19. Gastric juice is
 - (1) Acidic
 - (2) Alkaline
 - (3) Neutral
 - (4) Slightly alkaline
20. Which part of the alimentary canal receives bile from the liver?
 - (1) Stomach
 - (2) Small intestine
 - (3) Large intestine
 - (4) Oesophagus
21. Bile is produced by
 - (1) Gall bladder
 - (2) Pancreas
 - (3) Spleen
 - (4) Liver
22. Largest gland in the body is
 - (1) Liver
 - (2) Pancreas
 - (3) Gastric gland
 - (4) Adrenal
23. Which one does not produce any digestive enzyme?
 - (1) Pancreas
 - (2) Liver
 - (3) Stomach
 - (4) Duodenum
24. The action of bile can be called
 - (1) Oxidation
 - (2) Emulsification
 - (3) Esterification
 - (4) Dehydrogenation
25. In which part of the alimentary canal food is finally digested?
 - (1) Stomach
 - (2) Mouth cavity
 - (3) Large intestine
 - (4) Small intestine

26. Choose the function of the pancreatic juice from the following.
 (1) Trypsin digests proteins and lipase carbohydrates
 (2) Trypsin digests emulsified fats and lipase proteins
 (3) Trypsin and lipase digest fats
 (4) Trypsin digests proteins and lipase emulsified fats
27. The main function of intestinal villi is
 (1) Stimulate peristalsis
 (2) Distribute digestive enzymes uniformly.
 (3) Provide large surface area for absorption
 (4) None of these
28. The end product of fat digestion is
 (1) Glucose (2) Fatty acids and Glycerol
 (3) Amino acids (4) Alkaloids
29. A good source of lipase is
 (1) Saliva (2) Gastric juice
 (3) Bile (4) Pancreatic juice
30. Which set of juices is mixed with the food in small intestine?
 (1) Saliva, gastric juice, bile
 (2) Gastric juice, bile, pancreatic juice
 (3) Bile, pancreatic juice, intestinal juice
 (4) Bile, pancreatic juice and saliva

True or false

- In photosynthesis chemical energy converts into light energy.
- Oxygen and water are the raw material for photosynthesis.
- Guard cells regulate the opening and closing of stomata.
- Rate of photosynthesis is maximum in green light.
- CO₂ is released as a byproduct of light reaction.
- Enzymes are biological catalysts.
- The tongue helps in mixing food with saliva.
- Digestion of starch starts in the stomach.
- Liver is a gland associated with the digestive system.
- The gall bladder temporarily stores bile.

Fill in the blanks

- Photosynthesis is an process.
- is a natural source of light for photosynthesis.
- The process of absorption and conversion of energy into energy by green plants is called as photosynthesis.
- When the guard cells swell due to the entry of water, the stomata gets
- regulate the opening and closing of the stoma and also perform photosynthesis.
- The water molecules split into hydrogen and oxygen with the help of energy.
- is released as a byproduct of light reaction occurring during photosynthesis.
- Nitrogen is taken up by plants in the form of and
- Man has 4 kinds of teeth :
 (i) (ii) (iii)
 and (iv)
- Bile and pancreatic ducts open into.....

Match the column

- Match the contents of the column-I with column-II

Column-I	Column-II
(1) Photolysis	(a) CO ₂ and water
(2) Raw material for photosynthesis	(b) Splitting of water into H ₂ and O ₂
(3) Electromagnetic spectrum	(c) Light energy converts into chemical energy
(4) Photosynthesis	(d) Sunlight

- Match the contents of the column-I with column-II

Column-I	Column-II
(1) Saliva	(a) Complete digestion of food
(2) Pancreas	(b) Pepsin
(3) Liver	(c) Trypsin
(4) Stomach	(d) Ptyalin
(5) Intestine	(e) Bile

EXERCISE # 1

ANSWER KEY

Multiple choice questions

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	3	3	2	1	2	2	3	3	3	2	1	2	3	2	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	3	2	1	1	2	4	1	2	2	4	4	3	2	4	3

True or false

1. False 2. False 3. True 4. False 5. False 6. True 7. True 8. False 9. True 10. True

Fill in the blanks

1. anabolic 2. Sunlight 3. light, chemical 4. open 5. Guard cells 6. light
 7. O₂ 8. nitrates and nitrites 9. (i) Incisors, (ii) Canines, (iii) Premolars, (iv) Molars
 10. small intestine

Match the column

1. (1)-(b), (2)-(a), (3)-(d), (4)-(c), 2. (1)-(d), (2)-(c), (3)-(e), (4)-(b), 5-(a)

EXERCISE # 2

Very short answer type questions

1. Name the factors which affect photosynthesis.
2. Write complete reaction of photosynthesis.
3. Name the cellular organelle where photosynthesis process occurs.
4. Give the function of guard cells.
5. Name the most common method of ingestion in *Amoeba*.
6. Why is food vacuole of *Amoeba* called temporary stomach?
7. Name different types of teeth present in man.
8. Name the enzyme present in human saliva. What type of food material is digested by this enzyme?
9. Name the enzymes present in stomach.
10. Name the largest gland of the human body.
11. Which part of the body secretes bile? Where is bile stored?
12. Which part of alimentary canal is adapted for complete digestion and absorption of food?
13. Name the protein-digesting enzymes present in pancreatic juice of man.
14. What are the end-products of fat digestion?
15. Where does absorption of water from undigested food takes place?

Short answer type questions

1. Is nutrition necessary for an organism? Explain.
2. Differentiate between an autotroph and a heterotroph.
3. Describe various modes of nutrition.
4. "All plants give out oxygen during day and carbon dioxide during night." Do you agree with the statement? Give reason.
5. If a plant is releasing carbon dioxide and taking in oxygen during the day, does it mean that there is no photosynthesis occurring? Justify your answer.
6. How do the guard cells regulate opening and closing of stomatal pores?
7. Name the following
 - (a) The process in plants that links light energy with chemical energy.
 - (b) Organisms that can prepare their own food.
 - (c) Cells that surround a stomatal pore.
 - (d) Organisms that cannot prepare their own food.
 - (e) An enzyme secreted by gastric glands in stomach that acts on proteins.

8. What are the adaptations of leaf for photosynthesis?
9. Two green plants are kept separately in oxygen free containers, one in dark and the other in continuous light. Which one will live longer? Give reasons.
10. Leaves of a healthy plant were coated with vaseline. Will this plant remain healthy for long? Give reasons for your answers.
11. Mention various steps of nutrition in *Amoeba*.
12. What causes movement of food inside the alimentary canal?
13. What will happen if mucus is not secreted by gastric glands?
14. What is the significance of emulsification of fats?
15. Why does absorption of digested food occur mainly in the small intestine?

Long answer type questions

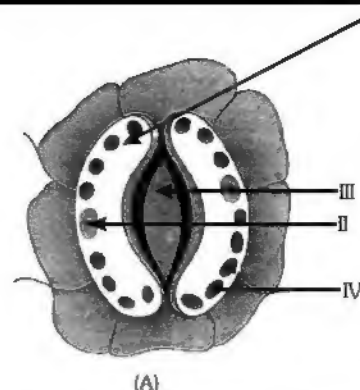
1. (a) Is green light most or least useful in photosynthesis and why?
(b) Describe an activity to show that chlorophyll is necessary for photosynthesis in plants.
2. (a) Draw the diagram of cross-section of a leaf and label the following in it :
 - (i) Chloroplast
 - (ii) Guard cell
 - (iii) Lower epidermis
 - (iv) Upper epidermis
 (b) Name the two stages in photosynthesis.
3. (a) Write one function each of the liver and the pancreas.
(b) Define the terms 'nutrition' and 'nutrients'. List two differences between 'holozoic nutrition' and 'saprophytic nutrition'. Give two examples each of these two types of nutrition.
4. Name the main organs of the human digestive system in the order they participate in the process of digestion. Describe how digestion of carbohydrates and proteins takes place in our body.
5. Draw a diagram of the 'human alimentary canal'. Label the following parts on it :
 - (a) Liver
 - (b) Pancreas
 - (c) Gall bladder
 - (d) Duodenum

Activity based questions

- Before carrying out the test for presence of starch in a leaf, the leaf is kept in alcohol contained in a beaker and boiled over a water bath. The step is required to
 - Extract starch
 - Dissolve chlorophyll
 - Make membranes of leaf cells more permeable
 - Allow water to move into leaf
- A black strip of paper was clipped on a destarched leaf in a potted plant to cover a part of leaf. The plant was exposed to sunlight for four hours. The strip was removed and leaf tested for starch. When iodine solution was added
 - Uncovered part of leaf became blue-black
 - Colour of iodine solution remained unchanged
 - Covered part of leaf became blue black
 - Entire leaf turned blue black
- Given below are steps to be followed for performing starch test on green leaf
 - Boil the leaf in alcohol
 - Boil the leaf in water
 - Dip the leaf in iodine solution
 - Wash the leaf in water

Which one of the following sequence should the students follow to get the correct result?

 - (i), (iv), (ii), (iii)
 - (iv), (i), (ii), (iii)
 - (ii), (iv), (i), (iii)
 - (ii), (i), (iv), (iii)
- Which one combination of relevant materials is required for setting up an experiment to show that light is necessary for photosynthesis?
 - Destarched leaves, strips of black paper, starch solution and iodine crystals.
 - Potted plant, strips of colored paper, starch solution, iodine and potassium iodide.
 - Destarched leaves, strips of black paper, starch solution and potassium iodide.
 - Destarched leaves, strips of black paper and iodine solution.
- In the following sketch of stomatal apparatus, parts I, II, III and IV were labelled differently by four students. The correct labelling is



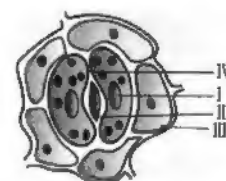
- (A)
- I-Guard cell, II-stoma, III-starch granule, IV-nucleus
 - I-Cytoplasm, II-nucleus, III-stoma, IV-chloroplast
 - I-Guard cell, II-starch, III-nucleus, IV-stoma
 - I-Cytoplasm, II-chloroplast, III-stoma, IV-nucleus

- The labelling of the slide of leaf peel showing stomata by four students who made the diagram and tabulated the labels.

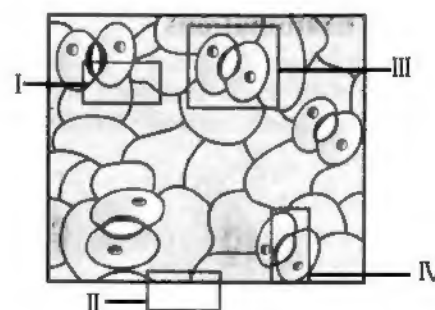
Student	I	II	III	IV
P	Stoma	Nucleus	Epidermal cell	Cell wall
Q	Nucleus	Stoma	Epidermal cell	Cell wall
R	Epidermal Cell	Stoma	Nucleus	Cell wall
S	Cell wall	Epidermal cell	Nucleus	Stoma

The student who made the correct labelling is

- P
- Q
- R
- S



- Shown below are four parts of a slide of an epidermal peel marked I, II, III and IV. Which part out of these four should be focussed under high power to view complete stomata.

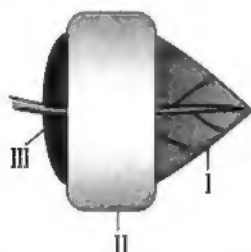


- I
- II
- III
- IV

8. Before setting an experiment on photosynthesis, a healthy potted plant is kept in a dark room for 24 hours to

- (1) Denature enzymes
- (2) Activate chloroplasts
- (3) Destarch leaves
- (4) Increased intake of carbon dioxide.

9. Given alongside is a sketch of a leaf partially covered with black paper and which is to be used in the experiment to show that light is compulsory for the process of photosynthesis. At the end of the experiment, which one of the leaf parts labelled, I, II and III will become blue black when dipped in iodine solution?



- (1) I only
- (2) II only
- (3) I and III
- (4) II and III

10. A student was asked to prepare a temporary mount of a leaf peel. Arrange the following procedural steps in correct sequence

- (i) Peel off a layer from surface of a leaf
- (ii) Put a drop of glycerine on a slide and place a cover slip
- (iii) Place peel on the slide and cut a small piece of the peel
- (iv) Stain with safranin
- (v) Wash off extra stain

- (1) i, ii, iii, iv, v
- (2) ii, i, iii, v, iv
- (3) i, iii, iv, v, ii
- (4) i, iv, v, iii, ii

ANSWER KEY

Q u e .	1	2	3	4	5	6	7	8	9	10
A n s .	2	1	4	4	2	2	3	3	3	3